Feedback from the real life

How science can help when concrete does not follow the theory

François Segrétaire – Lafarge France
Who I am

- François Segretain  Lafarge Béton  France
- Expert technical concrete for France
- I manage the amicable or legal disputes
- Specialist for all concrete constructions
- Pathologies for buildings, industrial floors, bridges and all civil engineering work …..
The problems I addressed with Gilles

I worked many times with Gilles about pathologies regarding

- Cracks
- Curling in concrete slabs
- Water dosages and drying
- Shrinkage
We often discussed the various pathologies related to construction in general and particularly in the concrete parts of constructions.

I explained to him the problems and the feedbacks we were getting through claims, and what were the most risky products.

… knowing the difficulties of manufacturing of our products and implementation by construction companies.
Various case studies
Lafarge Bétons in Nantes

- We started in 2003 during the construction of Lafarge Bétons offices in Nantes. Self-compacting concrete walls were instrumented to monitor humidity and temperature.

- Then a monitoring of cracking of the walls was conducted.
Conclusion from Gilles (and Bruno): these cracks have a double origine (construction system + material). However, the pretty high shrinkage is an important factor.
Warping of a slab-on-ground

- 4cm-warping of a 25cm-thick concrete slab

- Gilles: « Warping is then proportional to shrinkage, to the square of the length and inversely proportional to the thickness »

- Gilles: « After discussion with Rémi, we wondered about a possible swelling phenomenon, however this swelling would have been blocked by the shoulders. Therefore I have no convincing explanation. The previous calculation is only a superior bound. I am finally advising magics! »
Study of a crack-free building (Tokyo) 2009

Gilles: « To build a crack-free building is certainly possible. It takes a good mastery of material/structure interactions + concrete mix-design. As for bubbles, this is an even more complex technological aspect, but we start getting solutions through the ASC project »

Cracks curve on a slab
Concrete crack of industrial soil in La Rochelle

Gilles: «… hot-weather concreting. Strength losses can come. Have a look on plastic shrinkage nomograms from Québec or from belgian Febelecem very good documents
- Differential shrinkage in a grain silo due to changes in water/cement ratio

- Gilles: “This interesting nomograms gives good order of magnitudes”
Setting time in-place measurement

- Humm probe to detect concrete setting
- This probe was tested by industrial soils contractors in order to detect the beginning of the setting process
- LCR developed a specific apparatus
Dusty red concrete soil

- Dusting of a red concrete school yard: all kids were red and dusty!

- Gilles: « Quick drying without curing compound »
Explanations on air entrainment

Presentation to the technical staff about the mechanisms of air-entrainment, and the protection given to hardened concrete submitted to freeze-and-thaw.

Without AEA

With AEA

The volume of freezing water expands by 9%, creating degradation of concrete.

Entrained air bubbles allowing the free expansion of ice.
Delayed Ettringite Formation

- DEF (Delayed Ettringite Formation) on structures and shrinkage cracks
- LCR meeting with our experts for DEF
- Expertise on various case studies
- + Pathology of industrial floors: cracking, curling, peeling of the top layer
Gilles’ attitude with practitioners

- Gilles had a real passion for concrete, in theory and practice, in the books, in the laboratory and in the real life

- He was committed not to leave a question without any answer

- When I asked him a question, he made it a point of honor to find an explanation with strong references to reports, to publications from different countries or to his own experience
Thank you for your attention!